ESTCP Project WP-0801, UV Curable Powder Coatings for Military Applications

Presenter: Mr. Christopher W. Geib,
Science Applications International Corporation
(SAIC)
937.431.4332
geibc@saic.com

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
MAY 2009		**00-00-2009 to 00-00-2009**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
ESTCP Project WP-0801, UV Curable Powder Coatings for Military Applications	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Science Applications International Corp,4031 Colonel Glenn Highway,Beavercreek,OH,45431**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES
Presented at the NDIA Environment, Energy Security & Sustainability (E2S2) Symposium & Exhibition held 4-7 May 2009 in Denver, CO.

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**Same as Report (SAR)**	**19**	

Outline

- UV-Curable Powder Coatings Overview
- Robotics as an aid to Curing
- Current Status of ESTCP Project WP-0801
- Future UVCPC efforts

UV-Curable Powder Overview

- Previous ways of thinking about powder
  - Coating cure temperatures – typically above 428°F
  - Prohibitive for use on tempered metals (Al, Mg, Ti)
  - Prohibitive to use on composites
  - Powder coatings were designed as barrier protection

UV-Curable Powder Overview

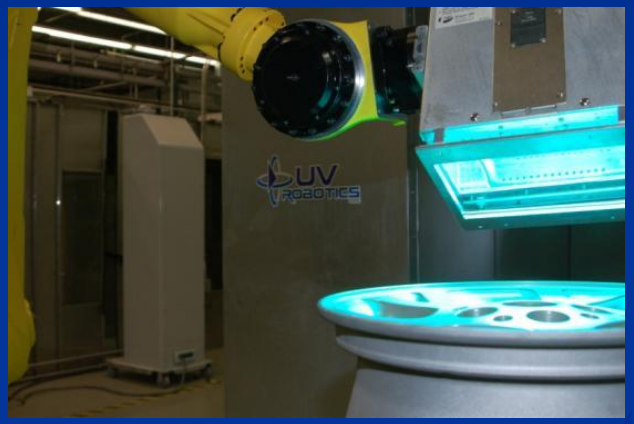
- Modern powder coatings can be formulated to have:
  - Lower melt & flow temperatures (< 225°F)
  - UV or EB cure functionality can be added
  - Various advanced non-chrome corrosion inhibitors

UV-Curable Powder Overview

- Advantages of UV-cure powder coating:
  - Elimination of volatile organics (VOC)
  - Elimination of hazardous air pollutants (HAP)
  - Reduction/elimination of hazardous waste
  - Transfer efficiencies as high as 95% (w/reclaim)
  - Decrease in thermal exposure.
  - Large bulky parts that cannot fit into existing ovens can be coated and cured.
  - UV-cure powder requires less energy because the energy is focused to a specific part only as long as needed.

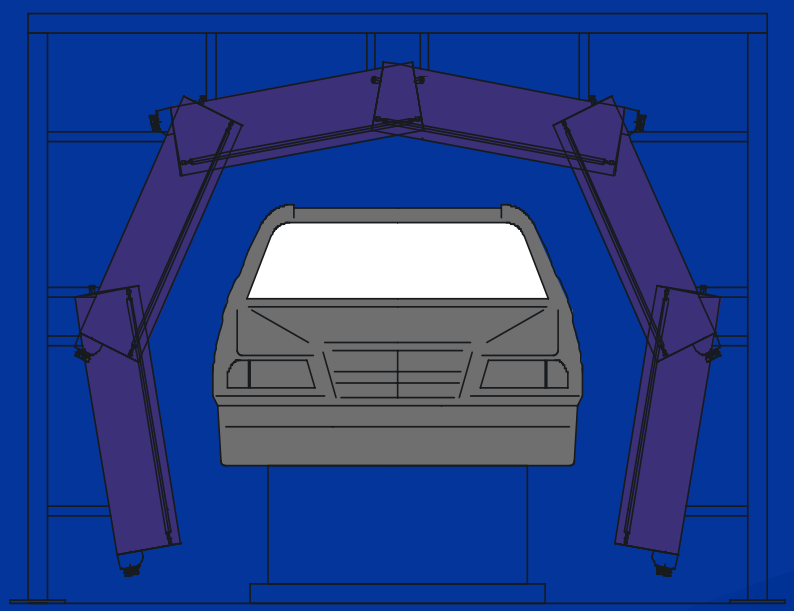
Robotics as an Aid to Curing

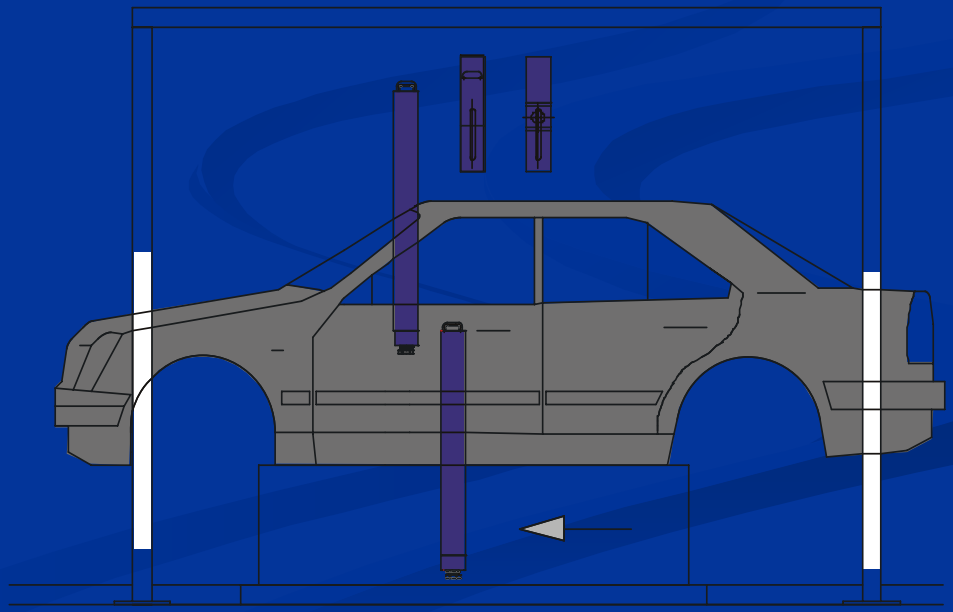
- Why Use Robots?



Robotics as an Aid to Curing

- Light tunnel approach using various size UV lamps to optimize cost and exposure





Robotics as an Aid to Curing

- Drawbacks of fixed lamp approach
  - High Capital Costs
    - Lamps, cooling, fixtures, integration
  - High Operating Costs
    - Replacement parts
    - Energy
    - Downtime
  - Technical Adequacy
    - Complete cure
    - Proper Re-alignment
    - Mixed product

Robotics as an Aid to Curing

- Advantages of Robotic Curing
  - Robots ensure repeatability
  - Robots with UV sources can maintain extremely close target distances
  - Robots can be re-programmed in seconds
  - Robotic curing is well suited to large or complex parts
  - Robots eliminate need for many lights

Current Status of ESTCP Project WP-0801

- The Problem:
  - DoD spends millions of dollars annually on solvent-based coatings
  - Hexavalent chrome primer use still very widespread
  - Contains or requires volatile solvent use
  - Significant hazardous waste costs
  - Hazardous materials pose risks to human health and environment
  - Process times measured in hours to days
  - Transfer rates are less than 60%

Current Status of ESTCP Project WP-0801

- The WP-0801 Objectives are:
  - Demonstrate a VOC/HAP-free, Ultraviolet cure powder coating (UVCPC) on DoD hardware
  - Demonstrate state-of-the-art robotics for curing

Current Status of ESTCP Project WP-0801

- Requirements of a UVCPC for military use:
  - Must perform at least as well as MIL-PRF-23377 primer
  - Must also perform as well as MIL-PRF-85285 topcoat
  - Can be prepared in gloss, semi-gloss, and flat finishes

Current Status of ESTCP Project WP-0801

- Planned demonstration weapon systems:

EA-6B wheels, landing gear

HH-65 helicopter

P-3 wheels, landing gear, radomes

Mk-48 ADCAP torpedo

HC-130 main landing gear doors

KC-135 wing flap, refueling boom

Current Status of ESTCP Project WP-0801

- Planned demonstration weapon systems (cont.):

Submarine icecaps

EA-18G wheels, landing gear

Ammunition and storage cases

Submarine communication buoys

Submarine interior components

Current Status of ESTCP Project WP-0801

- Powders:
  - Currently considering two vendors
  - Two colors, gloss white, semi-gloss gray
  - All will undergo strict validation testing at CTIO
- Robotics system:
  - Robot carries the IR and Hg vapor UV lamps
  - Evaluation of alternative UV sources continue
  - Evaluation of alternative application methods continue

Current Status of ESTCP Project WP-0801

- Major Program Milestones:
  - Joint Test Protocol submitted Sept 2008
  - Robot acquired and integration underway
  - Component identification complete
  - Powder and substrates order Jan 2009
  - Validation testing starts Feb 2009
  - Draft Demonstration Plan June 2009
  - Field Service/Demonstration begins Mar 2010
  - Joint Test Report draft Sept 2010
  - Final Report Mar 2012

Future UVCPC Efforts

- Future follow on efforts include large marine applications

Future UVCPC Efforts

- Future efforts in alternative UV light sources

High Energy UV LEDs

Pulsed Xenon lamps

Thank You!

Points of contact for UV-curable Powder Coatings ESTCP Project WP-0801:

Mr. Corey Q. Bliss
Principal Investigator
Air Force Research Laboratory/RXSSO
Wright-Patterson AFB, OH 45433
Corey.Bliss@wpafb.af.mil
(937) 255-0943

Mr. Christopher W. Geib
Co-Principal Investigator
Science Applications International Corp.
4031 Colonel Glenn Highway
Beavercreek, OH 45431
Christopher.W.Geib@saic.com
(937) 431-4332